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"Welcome Shelter Near Trail's End"

FEDERAL-STATE COOPERATIVE SNOW SURVEYS AND IRRIGATION WATER FORECASTS

for

MONTANA

MARCH 1, 1947

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U. S. DEPARTMENT OF AGRICULTURE

by

Montana Agricultural Experiment Station
and
Division of Irrigation, Soil Conservation Service
United States Department of Agriculture

in cooperation with

U. S. Forest Service
U. S. Geological Survey
U. S. National Park Service
State Engineer of Montana

FEDERAL-STATE COOPERATIVE

SNOW SURVEYS AND IRRIGATION WATER FORECASTS

FOR

MONTANA

Report Prepared

by

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Division of Irrigation
Soil Conservation Service
and
Montana State Agricultural Experiment Station
Bozeman, Montana

WATER SUPPLY OUTLOOK IN MONTANA, MARCH 1, 1947

The outlook for a normal water supply for irrigation and other purposes as of March 1, is good based on the water content of the snow blanket on the higher watersheds over the state.

Average temperatures as reported at the close of February were slightly above normal. Records at two weather stations west of the Continental Divide show average temperatures 7° and 13° above normal.

Precipitation as reported by the U.S. Weather Bureau during February was below normal in the eastern and central divisions but averaged near normal in the western division. Above normal precipitation at a number of representative weather stations during October, November, and December has changed to below normal during January and February.

Stream flow as reported by the U.S. Geological Survey showed considerable fluctuation caused by periods of warm weather. The ice broke up on streams west of the Continental Divide. The mean flow of the Yellowstone at Corwin Springs was about 10% below normal.

Reservoir Storage

Storage in 11 irrigation reservoirs in the Missouri Basin having a total useable capacity of 583,270 acre feet were 59% full at the end of February compared to 56% a year ago. Five reservoirs that regulate the flow for power, having a total useable capacity of 549,490 acre feet were 80% full as compared to 75% full last year on a corresponding date. Fort Peck Reservoir contained 13,850,000 acre feet or 73% of its capacity at the end of February as compared to 12,520,000 acre feet or 66% of capacity a year ago.

In the Clarks Fork Drainage, 15 small irrigation reservoirs having a useable capacity of 186,645 acre feet, were 34% full at the close of February compared to 32% full a year ago.

Georgetown Lake and Flathead Lake, both of which store water for power purposes, have a useable capacity of 1,822,000 acre feet and were 44% full at the end of February. This compares with 48% a year ago.

SUMMARY OF SNOW SURVEYS BY PRINCIPAL WATERSHEDS
Missouri Basin

On the Gallatin Watershed the average water content at 7 locations was 10.1 inches which was slightly less than the average at the same locations last year but almost twice as much as on a corresponding date in 1945.

Madison River - The average water content of the snow cover was 11.7 inches as compared to 11.5 inches in 1946 and 7.65 inches in 1945. Generally speaking the present condition is better than the average for the period of record.

Jefferson River - Snow surveys are made at 5 locations on the Jefferson Watershed. The average water content at these 5 locations was 11.2 inches on March 1. This compares with an average of 9.4 in 1946 and 7.5 on a corresponding date in 1945. The present readings are all above the average for the period of record.

Main Stem Tributaries - Six snow courses are located on minor tributary watersheds between Three Forks and Great Falls. The average water content on these six snow courses was 11.6 inches on March 1st this year, as compared to 8.4 inches on March 1, 1946 and 5.5 inches March 1, 1945. Current readings were all equal to or greater than the average for the period of record.

Sun River - The Goat Mountain snow course furnishes the only measurements on the Sun River watershed. The average water content at this location on March 1st was 16.1 inches. This is nearly twice the water content in 1946 when the average was 8.4 inches. In 1945 the average was 4.6 inches. It is not expected that this extreme difference will be reflected in the runoff.

Marias River - On the Marias Watershed snow surveys are made at two locations which represent the snow pack. The average water content at these two locations on March 1st was 14 inches which was nearly 40% more than last year. On March 1, 1946 the average was 10.6 inches and in 1945, 7.05 inches.

Musselshell River - Snow Surveys are made at 5 locations on the Musselshell Watershed. The average water content of the snow pack at these 5 points was 8.2 inches which is only slightly above that of a year ago, when the average was 8.1 inches. In 1945 the average was 5.2".

Yellowstone Basin - Main Stem above Livingston - Snow surveys are made at 6 locations and the average water content observed March 1 was 9.5 inches, which compares with 9.1 inches in 1946 and 5.9 inches in 1945 on corresponding dates.

Shields River - A snow survey at the Porcupine Ranger Station near Wilsall on March 1 showed a water content of 4.1 inches which was 15% less than last year. In 1945 the reading was 2.8 inches. The water content at present is 11% above the 10 year average.

Boulder River - The water content at the Hells Canyon snow course was 4.1 inches on March 1. This was 24% above the 1946 reading but slightly below that of 1945. Considerable winter melting occurs at this location.

Clarks Fork - Surveys were made at two locations on the Clarks Fork watershed. The average water content was 6.7 inches on March 1st. Last year the average at these two points was 5.5 inches. The average for the period of record is 5.2 inches.

Columbia Drainage Basin - Bitterroot Watershed - The average water content at 3 locations on the Bitterroot Watershed was 20.8 inches on March 1st. This was 15% above that of 1946 and more than double the measurement in 1945. The readings at each point were considerably above the average for the period of record.

Blackfoot River - Snow surveys are made at two locations. The average water content at these points on March 1st was 22.3 inches,in 1946 the average water content was 20.8 inches and in 1945 it was 13.3. The present accumulation is much above the average for the period of record.

Clarks Fork Above Milltown - The average water content on 4 snow courses was 7.0 inches compared to 6.1 inches in 1946 and 3.0 inches in 1945.

Clarks Fork below Milltown - The average water content at 2 locations was 27.6 inches which was slightly less than last year. In 1945 the average was 16.7 inches. The present accumulation is considerably above the average for the period of record.

Flathead River - The average water content of two locations on March 1st was 28 inches. This compares with 24.6 inches in 1946 and 14.7 inches in 1945. The readings at both points were approximately 50% above the average for the period of record.

Kootanai - No reports available.

MONTANA SNOW SURVEYS MARCH 1, 1947

MISSOURI BASIN

WATERSHED and SNOW COURSE	LOCATION							SNOW COVER MEASUREMENTS				
								Water Content (inches)				Past Record
	No. or State	Sec. -- Lat.	Twp. (or)	Range -- Long.	Elev.	Date of Survey	Snow Depth (inches) 1947	Same 1947	Approx. 1946	Date 1945	Years of Record	Av. Water Content (inches)
Gallatin River												
Devil's Slide	Mont. 1	14	5S	6E	8100	3/1	63.6	16.0	18.7	10.9	13	14.2
Hood Mead,Ext.	" 2	22	4S	6E	6600	3/1	31.0	6.2	7.7	4.2	14	5.8
Mystic Lake	" 3	31	3S	7E	6600	3/3	28.4	7.7	8.1	4.2	12	5.9
New World	" 4	24	3S	6E	6600	3/3	37.5	10.7	10.8	5.5	6	7.8
Ross Peak	" 5	10	1N	6E	7000	3/1	23	5.4	8.1	4.5	9	6.3
21 Mile	" 6	1	11N	5E	7150	3/1	52.5	16.1	14.8	8.6	14	13.0
320 Ranch	"	12	9S	3E	6600	3/1	12.9	2.5	5.7	3.1	7	5.0
Madison River												
Hebgen Lake	" 7	22	11S	3E	6550	3/1	42.9	11.5	13.0	7.9	14	10.6
Norris Basin	" 9	44.3N		110.7W	7500	3/4	39.3	8.9	7.8	7.3	10	8.1
21 Mile	" 6	1	11S	5E	7150	3/1	52.5	16.1	14.8	8.6	14	13.0
West Yellowstone	" 8	34	13S	5E	6700	3/1	37.1	10.3	10.6	6.7	14	9.6
Jefferson River												
Elkhorn	" 11	15	4S	12W	8450	2/27	40.7	11.0	8.9	4.9	13	7.0
Flashlight	" 10	22	8S	7W		2/28	20.6	3.4	3.6	2.9	3	3.3
Gibbons Pass	" 13	4	2S	19W	7100	3/2	73.3	25.5	22.9	15.6	14	17.2
Miner Lake	" 12	10	6S	16W		3/2	38.7	10.4	7.7	4.0	3	7.4
Pipestone	" 14	11	1N	7W	7200	3/4	27	5.7	3.9	2.6	10	3.8

MONTANA SNOW SURVEYS MARCH 1, 1947

MISSOURI

DRAINAGE BASIN and SNOW COURSE	LOCATION No. or State	Sec. - - Lat.	Twp. (or)	Range - - Long.	Elev.	Date of Survey	Snow Depth (in.) 1947	SNOW COVER MEASUREMENTS Water Content (inches) Same 1947	Approx. 1946	Date 1945	Years of Record	Past Record Av. Water Content (inches)
Main Stem Above Great Falls												
Chesman	Mont. 18	2	8W	6W	6200	2/28	23.6	6.0	3.0	1.1	12	3.9
Kings Hill	" 25	35	13N	7E	7950	3/3	49.3	13.5	15.8	8.8	14	9.7
Rimini Lower	" 15	13	8N	6W	6250	3/1	36.8	9.1	4.9	3.4	13	4.9
Rimini Middle	" 16	13	8N	6W	6800	3/1	46.6	13.0	7.7	5.6	14	7.5
Rimini Upper	" 17	19	8N	5W	8000	3/1	53.8	16.3	10.8	7.4	13	9.3
Stemple Pass	" 19	16	13N	7W	6900	2/28	44.4	12.0	8.2	6.8	14	7.6
Sun River												
Goat Mt.	" 20	47.5N		112.9W	7000	3/1	49.2	16.1	8.4	4.6	14	7.6
Marias River												
Marias Pass	" 21	48.3N		113.4W	5250	3/1	63.4	23.3	15.8	9.6	14	13.4
Rocky Boy	" 22	15	28N	16E	5200	2/28	18.3	4.7	5.5	4.5	6	4.9
Mussellshell R.												
Crystal Lake	" 24	24	12N	17E	6100	3/3	43.2	9.7	11.5	6.3	6	9.7
Grasshopper	" 27	19	9N	8E	7000	3/1	24.1	5.2	3.6	3.5	10	3.7
Half Moon	" 23	22	12N	18E	6000	3/5	28.8	6.7	6.5	3.7	8	6.5
Kings Hill	" 25	35	13N	7E	7950	3/3	49.3	13.5	15.8	8.8	14	9.7
Orville Harris	" 26	31	10N	9E	6500	2/28	28.4	6.1	3.2	3.8	10	3.9

MONTANA SNOW SURVEYS MARCH 1, 1947

YELLOWSTONE

DRAINAGE BASIN and SNOW COURSE	LOCATION							SNOW COVER MEASUREMENTS					
								Snow Depth (in.)	Water Content (inches)				Past Record
	No. or State	Sec. - - Lat.	Twp. (or)	Range - - Long.	Elev.	Date of Survey		1947	Same 1947	Approx. 1946	Date 1945	Years of Record	Av. Water Content (inches)
Main Stem													
Blacktail Deere	Mont.	4	44.9N		110.6W	7500	3/4	41.1	10.0	10.3	5.7	6	9.4
Canyon	"	2	44.7N		110.5W	7750	3/1	42.8	11.3	10.3	7.1	12	9.0
Crevice Mt.#1	"	5	26	9S	9E	8400	3/1	3.8	8.8	7.7	5.9	9	7.6
Crevice Mt.#2	"	6	25	9S	9E	8150	3/1	41.2	9.5	8.5	6.2	8	8.1
Lake	"	1	44.6N		110.4W	7850	3/2	37.4	9.5	8.5	6.8	12	8.4
Lupine	"	3	44.9N		110.6W	7300	3/4	36.7	8.1	9.3	3.9	5	8.6
Shields River													
Porcupine	"	7	10	4N	10E	6500	3/1	18	4.1	4.8	2.8	10	3.7
Boulder River													
Hells Canyon	"	8	23	5S	12E	6000	3/4	14.6	4.1	3.3	4.2	8	3.4
Independence	"	9	22	7S	12E	8000					9.7	5	12.4
Clarks Fork													
Camp Senia	"	11	2	8S	18E	7890	2/28	28.5	6.2	4.7		10	4.3
Cooke City	"	10	25	9S	14E	7400	2/28	31.6	7.2	6.4	3.8	11	6.1

MONTANA SNOW SURVEYS MARCH 1, 1947

COLUMBIA

DRAINAGE BASIN and SNOW COURSE	LOCATION						SNOW COVER MEASUREMENTS					
							Water Content (inches)					Past Record
	No. or State	Sec. - - Lat.	Twp. (or)	Range - - Long.	Elev.	Date of Survey	Snow Depth (inches) 1947	Same 1947	Approx. 1946	Date 1945	Years of Record	Av. Water Content (inches)
Bitterroot												
Gibbons Pass	Mont. M13	4	2S	19W	7100	3/2	73.3	25.5	22.9	15.6	13	16.6
Nez Perce Camp	" 1	19	1S	23W	5580	3/3	49	15.8	13.8	9.1	9	9.7
Nez Perce Pass	Idaho	32	28N	16E	6575	3/3	62	21.3	17.5	13.6	10	13.3
Blackfoot R.												
Stemple	Mont. 19	16	13N	7W	6900	2/28	44.4	12.0	8.2	6.8	13	7.3
Stuart Mt.	" 9	6	14N	18W	7400	3/3	89	32.7	33.4	19.8	11	23.0
Clark Fork-Above Milltown												
Intergaard	Mont. 6	6	5N	13W	6450	2/27	31	6.6	5.9	2.4	11	4.9
Southern Cross	" 5	9	5N	13W	6500	2/27	17	3.8	4.8	1.5	11	4.1
Stemple	" M19	16	13N	7W	6900	2/28	44	12.0	8.2	6.8	13	7.3
Stuart Mill	" 4	19	5N	13W	6500	2/27	24	5.5	5.4	1.4	11	4.2
Clark Fork below Milltown												
Lookout	Idaho -	4	47N	6E	5250	2/28	91	33.9	37.0	18.4	22	28.1
Packers Meadow	" -	15	38N	15E	5700	2/27	61	21.4	19.7	15.0	10	16.3

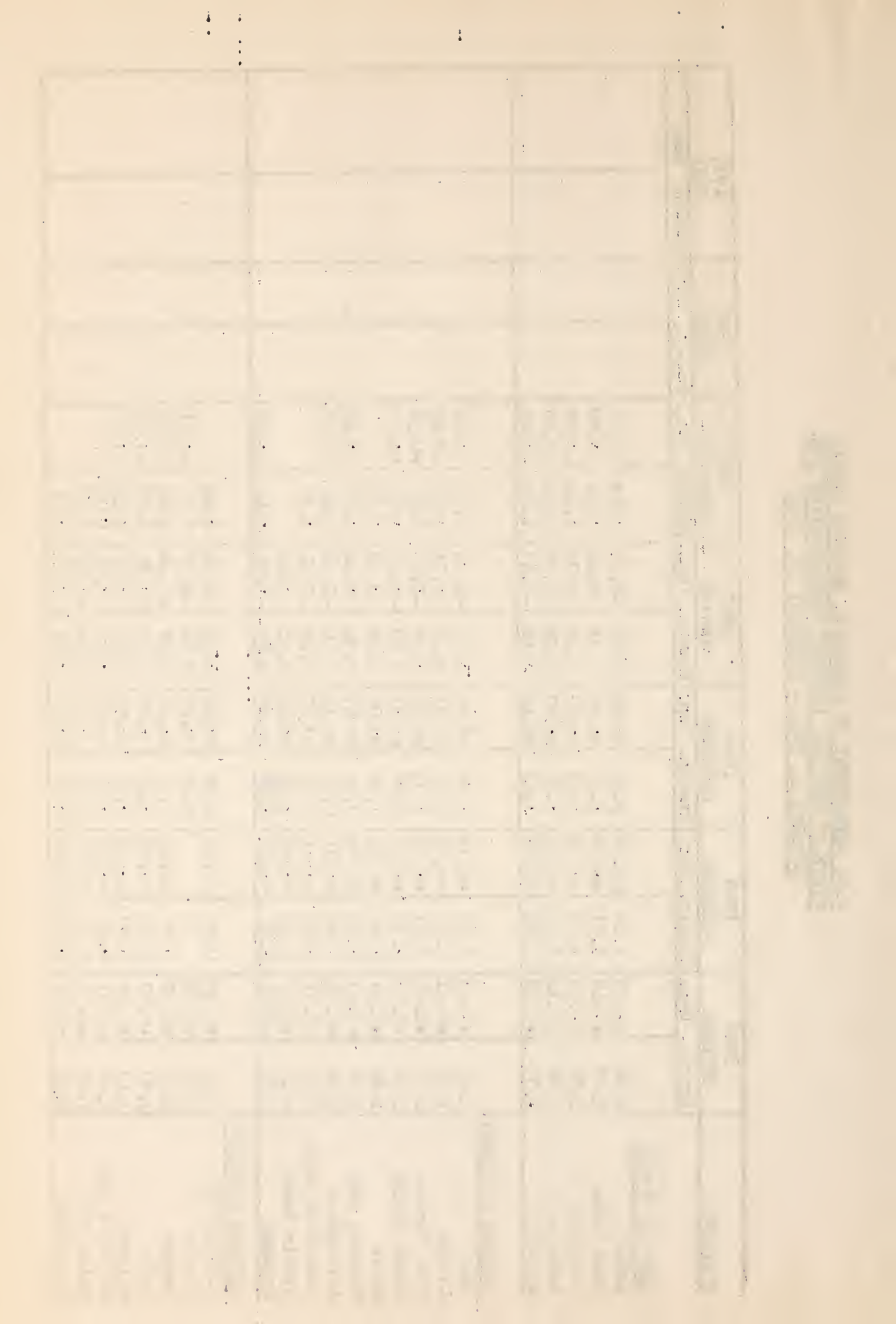
MONTANA SNOW SURVEYS MARCH 1, 1947

COLUMBIA

DRAINAGE BASIN and SNOW COURSE	LOCATION						SNOW COVER MEASUREMENTS					
							Snow Depth (in.)	Water Content (inches)			Past Record	
	No. or State	Sec. - - Lat.	Twp. (or)	Range - - Long.	Elev.	Date of Survey	1947	Same 1947	Approx. 1946	Date 1945	Years of Record	Av. Water Content (inches)
Flathead												
Marias Pass	Mont.	21 48.19N		113°21'W	5250	3/1	63.4	23.3	15.8	9.6	13	12.6
Stuart Mt.	"	9 6	14N	18W	7400	3/3	89	32.7	33.4	19.8	11	23.0

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
STATE OF MONTANA, MONTHLY PRECIPITATION FOR
OCTOBER 1, 1946 - FEBRUARY 28, 1947

STATIONS	1946 OCTOBER		1946 NOVEMBER		1946 DECEMBER		1947 JANUARY		1947 FEBRUARY		1947 MARCH		1947 APRIL	
	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.
WEST OF DIVIDE														
Butte	1.84	+1.05	1.19	+0.79	0.66	+0.22	0.65	+0.25	0.53	+0.11				
Deer Lodge	2.17	+1.49	1.31	+0.76	2.41	+1.90	0.18	-0.41	0.35	-0.08				
Hamilton	2.84	+1.93	2.19	+1.38	2.43	+1.72	0.44	-0.35	1.14	+0.39				
Kalispell	3.18	+2.12	1.99	+0.64	1.82	+0.37	1.00	-0.57	0.90	-0.21				
Missoula	2.33	+1.38	0.82	-0.08	1.43	+0.48	0.42	-0.43	1.05	+0.25				
CENTRAL DIVISION														
Babb	4.61	+3.43	1.38	+0.39	0.89	-0.05	0.70	-0.24	0.77	-0.05				
Dillon	1.35	+0.41	0.75	-0.05	0.23	-0.51	0.12	-0.71	0.32	-0.40				
Fort Benton	1.77	+1.05	0.63	+0.04	0.73	+0.27	0.25	-0.41	0.87	+0.38				
Great Falls	1.53	+0.67	1.78	+1.10	0.86	+0.21	0.50	-0.11	0.71	+0.16				
Havre	1.26	+0.59	0.66	+0.05	0.56	-0.05	0.23	-0.50	0.37					
Helena, WBO	1.24	+0.63	0.89	+0.04	0.94	+0.47	0.34	-0.22	0.37	0.00				
Livingston	1.98	+0.81	0.49	-0.31	0.74	+0.14	0.14	-0.40	0.41	-0.13				
Lewistown Arpt.	2.07	+1.71	0.62	+0.41	0.57	+0.37	0.22	-0.51	0.57					
Mystic Lake	4.11	+2.27	1.12	-0.46	1.32	+0.28	0.51	-0.63						
Bozeman	2.35	+0.93	0.85	-0.15	0.59	-0.39	0.83	-0.04	0.44	-0.27				
EASTERN DIVISION														
Billings #2	2.43	+0.98	0.66	-0.10	0.86	+0.22	0.39	-0.24	0.54					
Circle	1.35	+0.50			0.28	-0.47	0.30	-0.37	0.10	-0.51				
Frazer	0.97	+0.09	0.55	+0.02	0.55	+0.16	0.89	+0.48	0.30	-0.04				
Malta	0.82	+0.09	0.33	-0.08	0.42	-0.04	0.10	-0.37	0.25	-0.12				
Mildred	3.43	+2.69	0.79	+0.42	0.91	+0.59	0.13	-0.21	0.12	-0.14				
Medicine Lake	1.02	+0.27	0.24	-0.09	0.35	+0.07	0.16	-0.15	0.02					
Miles City	3.20	+2.30	0.41	-0.16	0.52	-0.11	0.34	-0.32	0.19					
Fort Peck	0.47	-0.28	0.46	-0.01	0.38	+0.10	0.11	-0.27	0.11					



STORAGE IN RESERVOIRS OF MONTANA

COLUMBIA RIVER BASIN — FEBRUARY 28, 1947

DATA FURNISHED BY OPERATING ORGANIZATIONS

COMPILED BY WATER RESOURCES BRANCH, U.S. GEOLOGICAL SURVEY, HELENA, MONT.

Reservoir	Located on or diverting from	Usable Capacity Acre-feet	Contents this date Acre-feet	Contents a year ago Acre-feet
Irrigation Purposes				
b Nevada Creek Res.	Nevada Cr. Res.	12600	9830	6720
b W.Fork Bitterroot	W.Fork Bitterr.	31700	10000	10000
d Little Bitterroot Lk.	Lt.Bitterroot.	18000	2400	600
d Hubbert Res.	Lt.Bitterroot	12100	1680	1250
d Upper Dry Fork	Dry Fork Cr.	2700	655	265
d Dry Fork Res.	Dry Fork Cr.	4000	1500	530
d Twin Res. Canals	Mission Valley	600	214	415
d Pablo Res. Canals	Mission Valley	25000	4630	3660
d Lower Crow Res.	Crow Creek	10350	8060	7890
d Kicking Horse Res.	Mission Valley	8350	5810	4400
d Ninepipe Res.	Mission Valley	14870	7420	8360
d McDonald Res.	Post Creek	8225	5260	6340
d Mission Res.	Mission Creek	7250	2650	3330
d Tabor Res.	Dry Creek	23300	3690	6490
d Lower Jocko	Mission Valley	7600	0	0
		186645	63799 34%	60250 32%
Power Purposes				
a Georgetown Lake	Flint Creek	31000	22190	23220
a Flathead Lake	Flathead River	1791000	782600	851000
		1822000	804790 44%	874220 48%

Data furnished by:

a Montana Power Company
b U.S. Army Engineers
c Montana State Water Conservation Board
d U.S. Bureau of Reclamation
e Office of Indian Affairs
f Valier, Montana, Land & Water Company

STORAGE IN RESERVOIRS OF MONTANA

MISSOURI RIVER BASIN — MARCH 1, 1947

DATA FURNISHED BY OPERATING ORGANIZATIONS

COMPILED BY WATER RESOURCES BRANCH, U.S. GEOLOGICAL SURVEY, HELENA, MONT.

Power Purpose Reservoir	Located on or diverting from	Usable Capacity Acre-feet	Contents this mo.	Contents year ago
[a] Lake Sewall	Missouri R.	37800	29970	35840
[a] Hauser Lake	Missouri R.	52090	49050	51700
[a] Holter Reservoir	Missouri R.	73600	56490	76020
[a] Hebgen	Madison R.	345000	267,600	209,500
[a] Madison	Madison R.	41000	34320	37970
		549490	437430 80%	411,030 75%
Purpose Irrigation				
[c] Ruby Reservoir	Ruby R.	38,850	31,190	35980
[d] Gibson R.	N.Fk.Sun R.	105000	58,180	64180
[d] Willow Creek	N.Fk.Sun R.	32,300	13640	10870
[d] Pishkun Res.	N.Fk.Sun R.	32,000	17230	22780
[e] Lower Two Medicine	Two Medicine	14,000	0	0
[e] Four Horns	Badger Cr.	20,000	10400	5,500
[f] Birch Creek Res.	Birch Cr.	30,000	28290	20610
[f] Lake Francis	Birch & Dupuyer	112,000	100600	95420
[c] Ackley Lake	Judith R.	5820	5240	2480
[d] Fresno Res.	Milk R.	127,200	55240	50440
[d] Sherburne Lake Res.	Swiftcurrent	66100	24420	20,200
		583270	344430 59%	328,460 56%
Navigation & Power				
[b] Ft. Peck Res.	Missouri R.	19000000	13850,000 73%	12,520,000 66%

Data furnished by:

a Montana Power Company
b U. S. Army Engineers
c Montana State Water Conservation Board
d U.S. Bureau of Reclamation
e Office of Indian Affairs
f Valier,Montana, Land & Water Company